the family possessing Property II is the set of conics having minor axes of an arbitrary constant length.

11. FOR THE LAW OF THE DIRECT DISTANCE. All orbits described under a force varying directly as the distance, are conics whose centers lie at the center of force. The force, expressed in terms of the constants of the conics, is given by

$$f=h^2/a^2b^2u; \tag{24}$$

so that h^2/a^2b^2 must be constant for all the orbits. If also h is proportional to a/b^2, it is necessary that b^6, and hence also b, remain invariant. Thus, for this law, the family possessing Property I is the set of conics having minor axes of a given length. The constant of areas must vary as the major axis in this family. To have Property I at the pericenters, interchange b and a in the preceding statements. Each of these families has Property III also.

Finally, to have the product of the apsidal distances constant requires the constancy of $a.b$ and also of h. Hence, for the law of the direct distance, the family possessing Property II is the set of conics having the product of the axes constant, or what is equivalent for ellipses, having a given (arbitrary) area.

ON THE IRREDUCIBILITY OF CERTAIN POLYNOMIALS.

By JACOB WESTLUND, Purdue University.

The object of the following note is to determine whether the two polynomials

$$f_1(x)=(x-a_1)(x-a_2)\ \dots\ (x-a_n)-1 \text{ and}$$
$$f_2(x)=(x-a_1)(x-a_2)\ \dots\ (x-a_n)+1,$$

where a_1, a_2, ..., a_n are distinct integers, are reducible or irreducible.

Let us first consider $f_1(x)$. If $f_1(x)$ were reducible we would have

$$f_1(x)=\phi(x)\psi(x),$$

where $\phi(x)$ is irreducible and of a lower degree than n. Then since

$$\phi(a_i)\psi(a_i)=-1,\ i=1,\ 2,\ \dots,\ n,$$

we must have

$$\phi(a_i)=\pm 1 \text{ and } \psi(a_i)=\mp 1.$$

Hence,

$$\phi(a_i)+\psi(a_i)=0,\ i=1,\ 2,\ \ldots,\ n;$$

and hence the equation

$$\phi(x)+\psi(x)=0,$$

whose degree is less than n, has n distinct roots, which is impossible. Hence, $f_1(x)$ is always irreducible.

Let us next consider $f_2(x)$. If $f_2(x)$ were reducible, we would have

$$f_2(x)=\phi(x)\psi(x),$$

where $\phi(x)$ is irreducible and of a lower degree than n. Then reasoning in the same way as in the first case we find that the equation

$$\phi(x)-\psi(x)=0,$$

which is of a lower degree than n, has n distinct roots. But this is impossible, unless $\phi(x)$ and $\psi(x)$ are identically equal. Hence the only case when $f_2(x)$ is reducible is when it is a perfect square, in which case n of course must be even.

A METHOD OF COMPUTING LOGARITHMS.

By C. E. WHITE, Nashville, Tennessee.

From the expansion $f(x)=f(a)+(x-a)f'(a)+\frac{(x-a)^2}{2\,!}f''(a)+\ldots.$ we derive by letting $a=x+h$ and $a=x-h$,

$$f(x)=f(x+h)-hf'(x+h)+\frac{h^2}{2\,!}f''(x+h)-\frac{h^3}{3\,!}f'''(x+h)+\ldots$$

$$f(x)=f(x-h)+hf'(x-h)+\frac{h^2}{2\,!}f''(x-h)+\frac{h^3}{3\,!}f'''(x-h)+\ldots$$

The above expansions may be used to an advantage in computing log-